Presentation of Findings

March 21, 2007

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North Dakota GISTC

Road Centerline Study

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Agenda

- Project description
- Survey findings
- GIS standards
- Sample area
- Statewide data development plan
  - Estimated cost/time
- Maintenance workflow

Project Background

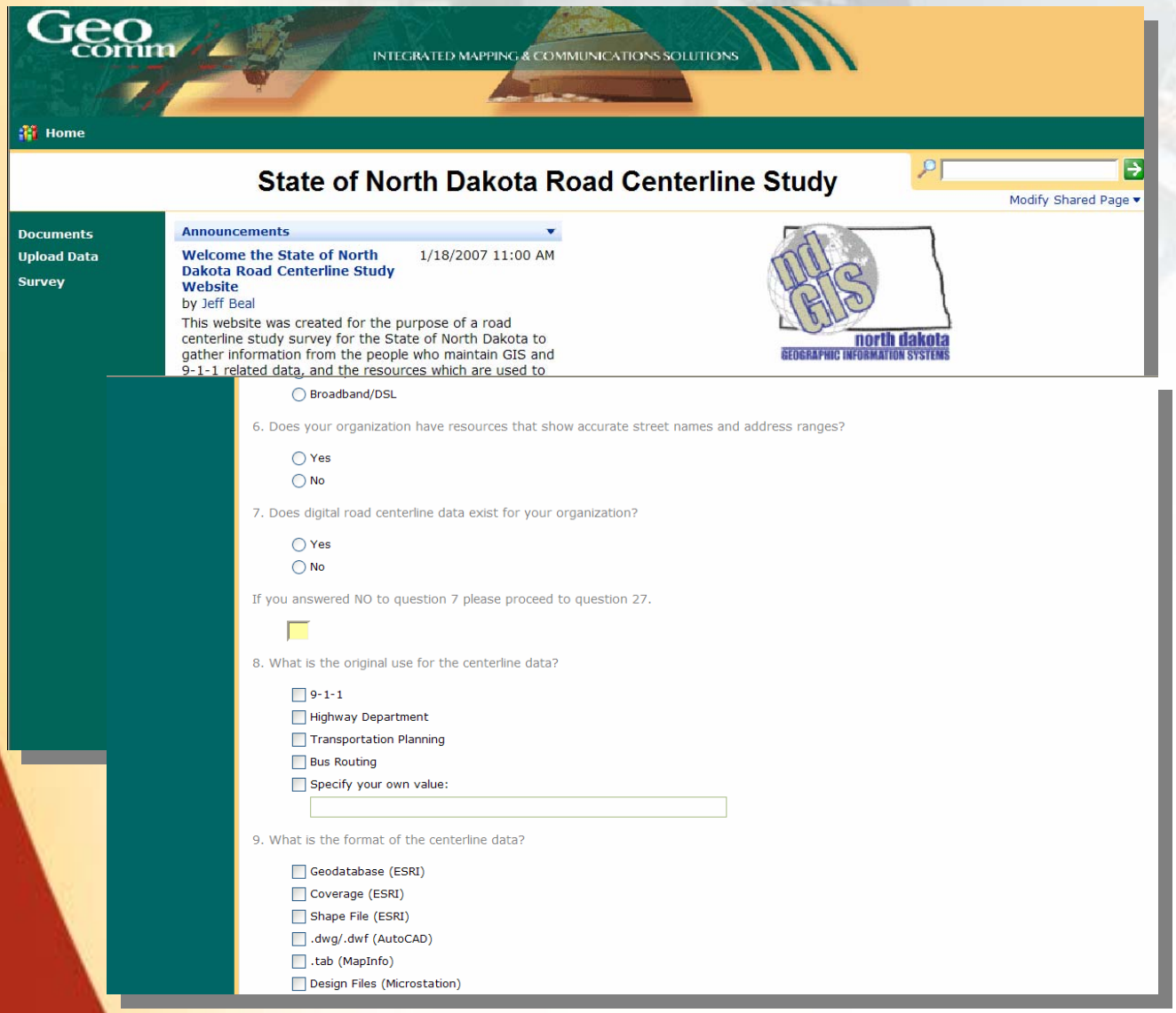
- Documentation of available data
- Development of data standards
- Cost effective methods for development of statewide centerline to meet the needs of emergency service agencies

How did we do this?

- Kick off meeting
- Surveys
  - Data gathering
  - Analysis
- Data review
- Sample data
- Experience

Survey Results

- Survey questions
  - Development and maintenance practices
  - Data structure
  - Data availability
  - Accuracy
- Support documentation
- Contact list provided by Project Coordinator
- Received 46 survey responses from 44 different jurisdictions
- Supplementary survey information



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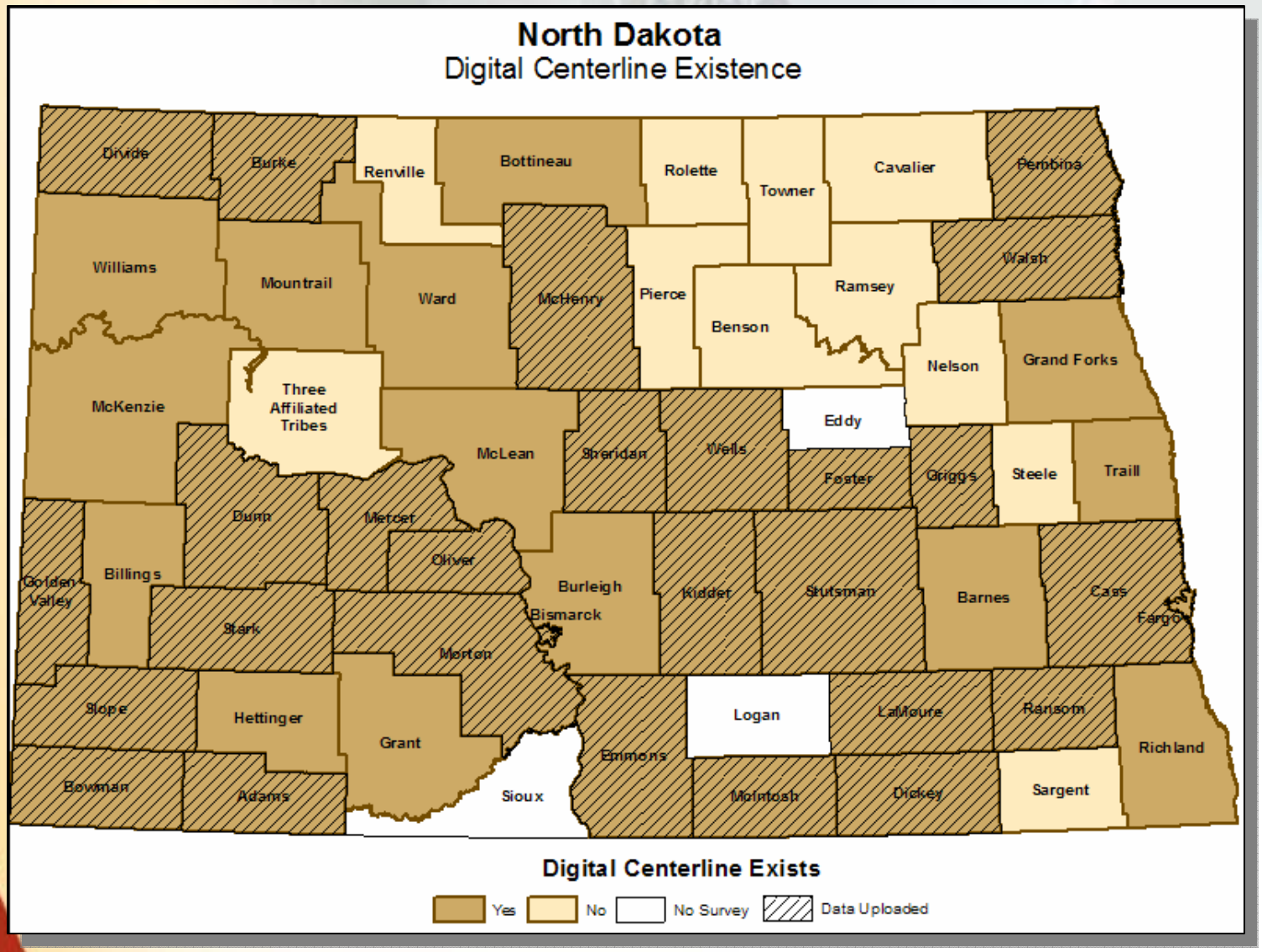
Centerline Status

Centerline Status	Total # of Jurisdictions
Has centerline data	42
No centerline data	11*
Undetermined	3

*Three Affiliated Tribes reported no data however, adjoining county data can be used for their area.



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Data Review

30 data sets provided

- 13 contained street name and address range information

Percentage of overlapping ranges	Number of Jurisdictions
0%-4.9%	6
5%-9.9%	4
>10%	3

Percentage of segments with dangles	Number of Jurisdictions
0%-4.9%	6
5%-9.9%	4
>10%	3

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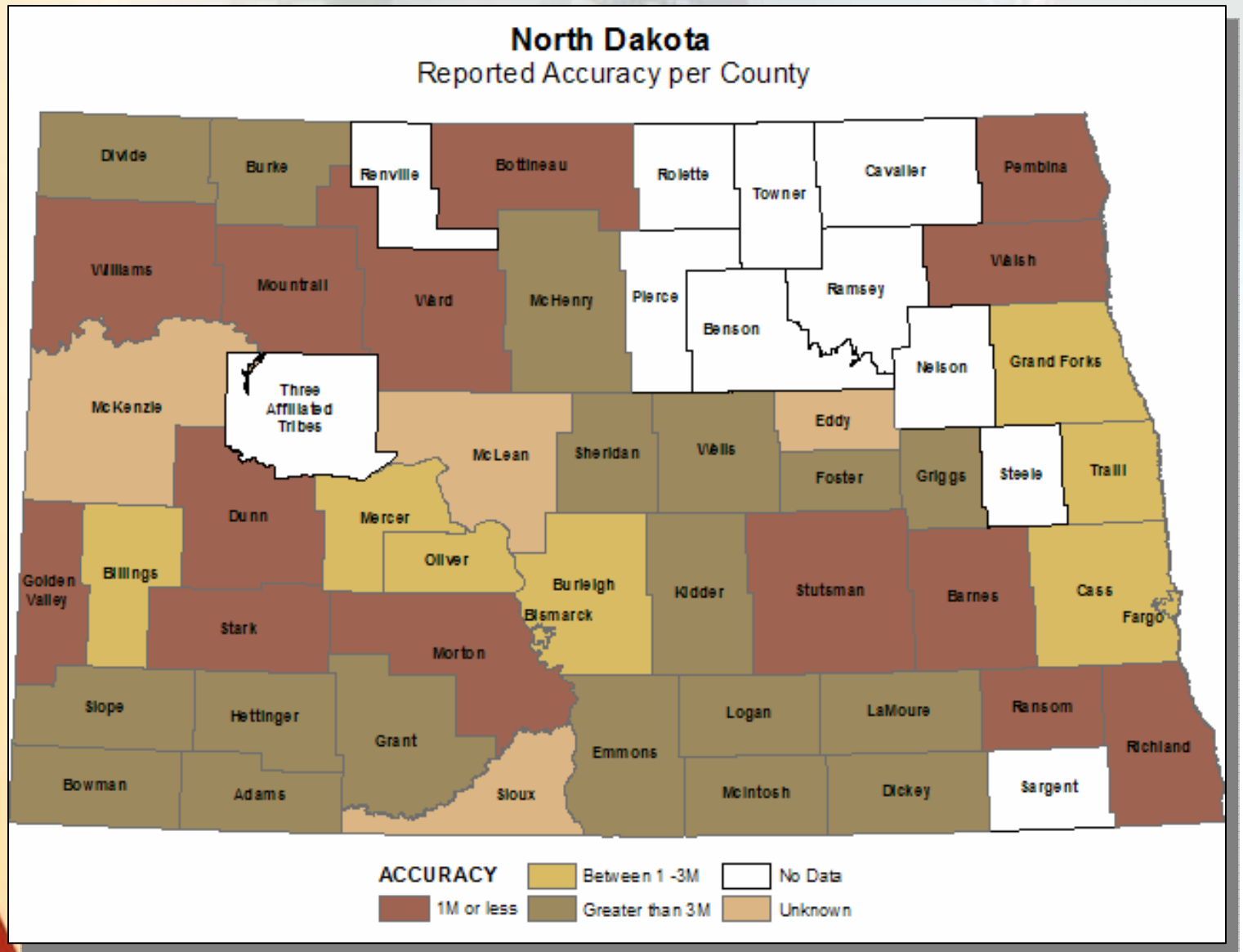
North Dakota
Reported Accuracy per County
Divide
Burke
Renville
Bottineau
Rolette
Towner
Cavalier
Pembina
Williams
Mountrail
Ward
McHenry
Pierce
Benson
Ramsey
Walsh
Nelson
Grand Forks
McKenzie
Three Affiliated Tribes
McLean
Sheridan
Wells
Eddy
Foster
Griggs
Steele
Traill
Dunn
Mercer
Oliver
Golden Valley
Billings
Burleigh
Bismarck
Kidder
Stutsman
Barnes
Cass
Fargo
Stark
Morton
Slope
Hettinger
Grant
Emmons
Logan
LaMoure
Ransom
Richland
Bowman
Adams
Sioux
McIntosh
Dickey
Sargent
ACCURACY
1M or less
Between 1 -3M
Greater than 3M
No Data
Unknown

Accuracy

County	2003 Mapping Accuracy	2007 Reported Accuracy
Barnes	Sub-Meter	No Survey
Billings	Sub-Meter	Unknown
Bottineau	Sub-Meter	1 Meter
Dunn	Sub-Meter	1 Meter
Grand Forks	Sub-Meter	4 Feet
Logan	Sub-Meter	No Survey
McLean	Sub-Meter	Unknown
Mercer	Sub-Meter	3 Meter
Mountrail	Sub-Meter	No Survey
Ransom	Sub-Meter	1 Meter
Renville	Sub-Meter	No Data
Richland	Sub-Meter	No Survey
Stark	Sub-Meter	1 Meter
Stutsman	Sub-Meter	Unknown
Ward	Sub-Meter	Unknown
Golden Valley	1-3 Meter	1 Meter
Morton	1-3 Meter	1 Meter
Pembina	1-3 Meter	1 Meter
Traill	1-3 Meter	3 Meter

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Centerline Availability

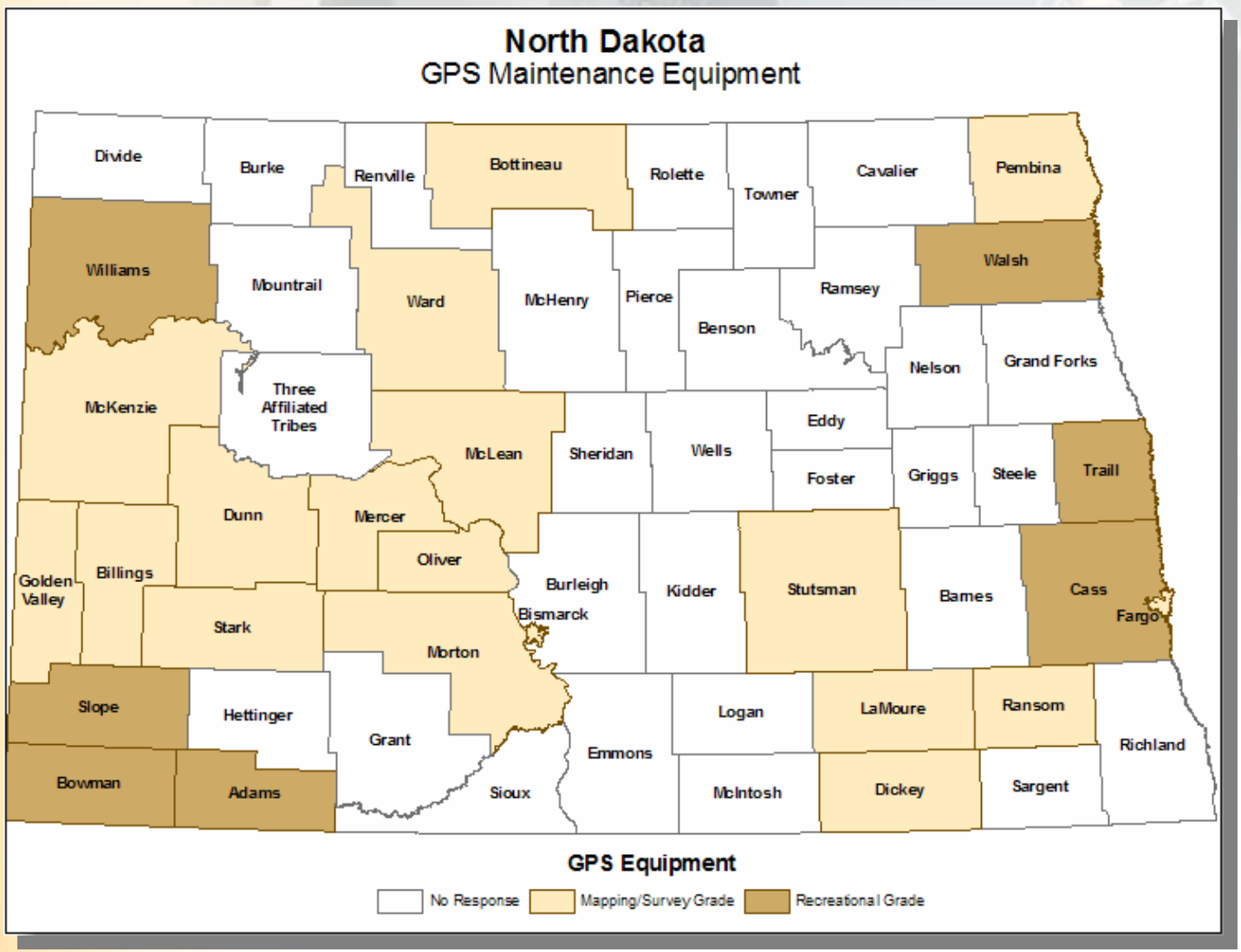
Centerline Availability	Jurisdictions
Will not provide data	7
Will provide data	20
Survey response Unknown	3
No data	17*
No survey response	10

*Reflects survey responses; SeaTol data exists for some areas included in this count

Maintenance

Understanding the maintenance process at the local level is important when developing a state maintenance program

Charge of Maintenance	Number of Jurisdictions
Internal	22
Contractor	3



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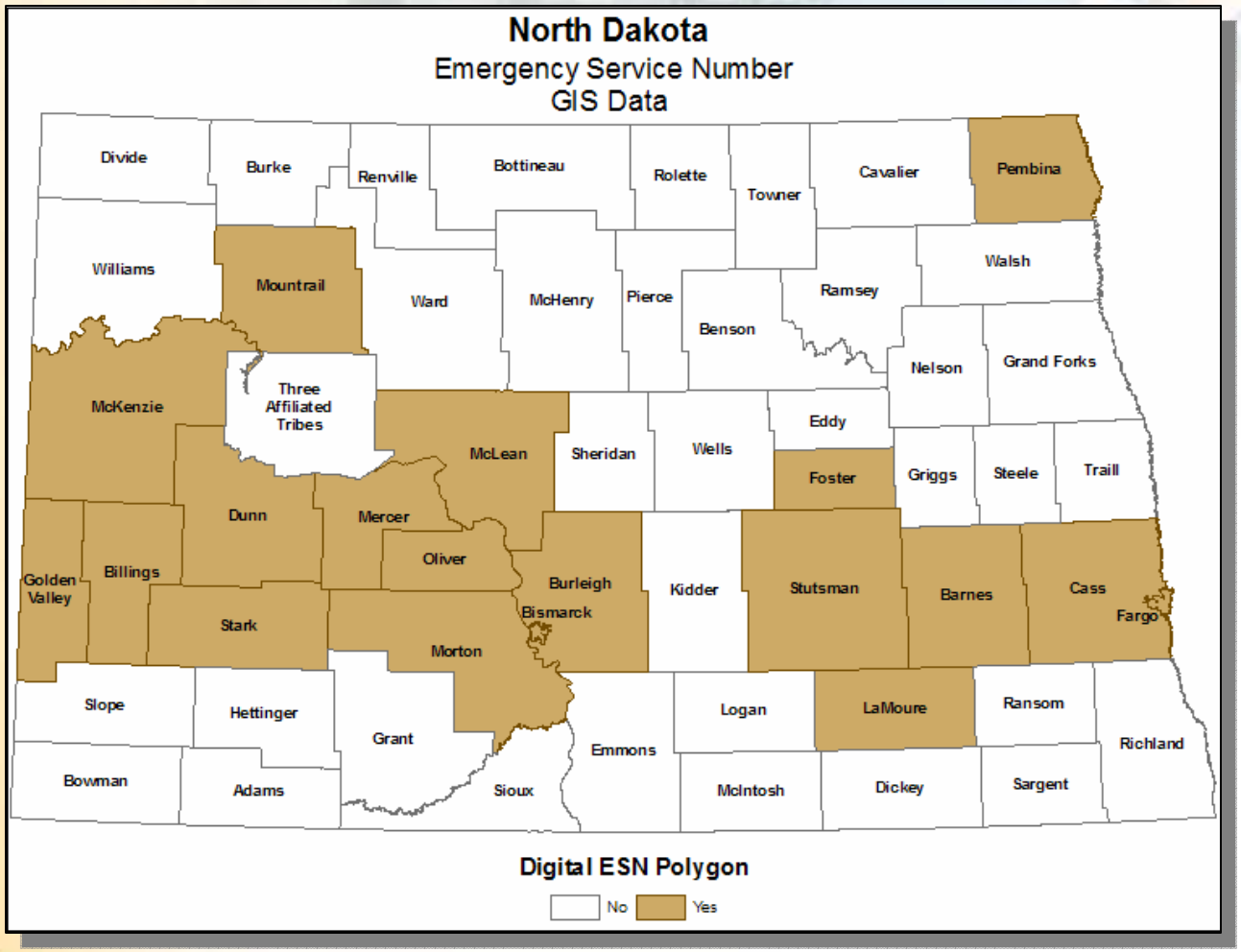
Reported Accuracy
Recreational Grade GPS Equipment

Interpretation of reported accuracy can be affected by the maintenance equipment

Recreational Grade GPS	Reported Centerline Accuracy
Adams	20ft+/-
Bowman	~10M +/-
Cass	5Ft+/-
Slope	~10M +/-
Traill	3M

Emergency Service Number (ESN)



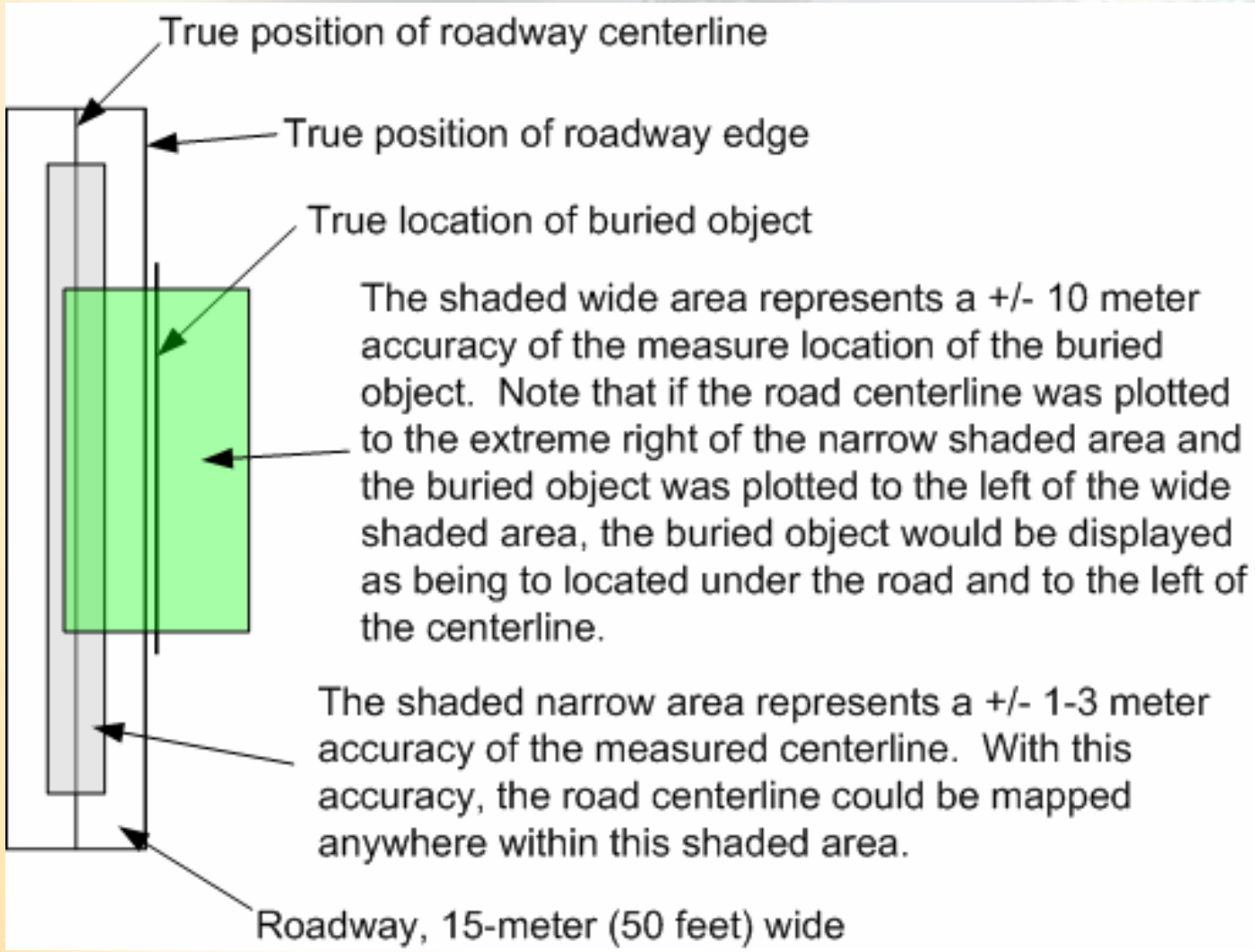
North Dakota Road Centerline Data Standards

Recommendations

- Projection –
  - Geographic Coordinate System (NAD 83)
- Format
  - Enterprise geodatabase
- Spatial Accuracy
  - Between 1-3 Meters 95% of the time

Accuracy recommendation based on:

1. 50% of the reporting organizations already have accuracies of 1-3 meters or better.
2. 45% of the reporting organizations are using procedures and equipment capable of mapping at 1-3 meters or better..
3. Spatial relationships
4. Falls within NENA Standards
5. Accuracy standards in other states


True position of roadway centerline
True position of roadway edge
True location of buried object
The shaded wide area represents a +/- 10 meter accuracy of the measure location of the buried object. Note that if the road centerline was plotted to the extreme right of the narrow shaded area and the buried object was plotted to the left of the wide shaded area, the buried object would be displayed as being to located under the road and to the left of the centerline.
The shaded narrow area represents a +/- 1-3 meter accuracy of the measured centerline. With this accuracy, the road centerline could be mapped anywhere within this shaded area.
Roadway, 15-meter (50 feet) wide

Other considerations

- Topological relationships
- Testing costs for validation
- Greater visual disparity

But when you look at data development:

- Development options
  - Existing data
  - Available resources
    - NAIP +/- 3 Meters to Quads
    - Quads +/- 10 Meters
    - Census +/- 7.6 Meters
- GPS capable of gathering at 1 meter or better
- Development of spatial information from aerial imagery is excellent development technique if imagery meets accuracy standards

This report thus concludes that 1 meter or better should in fact be the North Dakota road centerline positional accuracy standard.

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Additional Standards

- Street names
- Address ranges
  - Accept theoretical but actual preferred when funding allows
- Routing
  - minimal fields based on current applications
- Feature level metadata
- NDDOT attributes
  - Route ID
  - F_Mile
  - T_Mile
- KLJ attributes
  - Zip codes
  - Additional fields for routing
- Development standards
  - Broken and snapped at intersections

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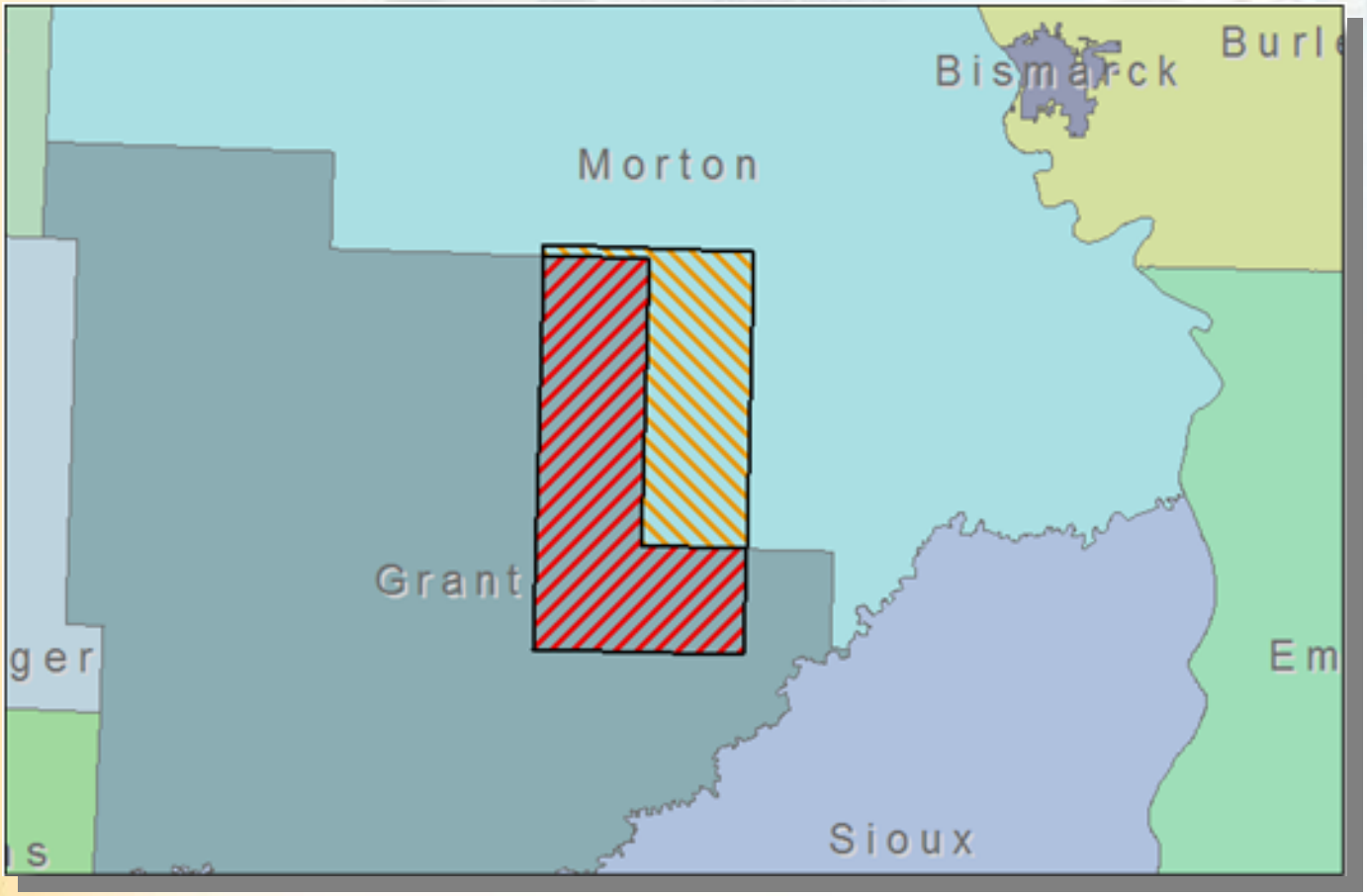
Sample Area



5 Townships - Grant Co

3 Townships – Morton Co

Sample Area Goals

- Created using recommended project procedures
- Proved concept of using multi-jurisdictional data
- NDDOT data incorporated into data

Sample Area Procedures

- Merging existing datasets
- Edge-matching
- Centerline alignment to FSA-NAIP aerial digital orthophotos
- Attribute development
- Conflation of NDDOT Data

Sample Area Considerations

- Hierarchy plan for edge-matching
- Attribute development function of resource availability
- Incorporation of NDDOT data
  - Conflation
  - Conversion

Statewide Development Plan

Classification	Definition	Spatial Development	Attributes Development
A	Spatial and attribute data meet recommended standards	None	None
B	Spatial data do not meet recommended standards, attributes meet standard	Spatially adjust existing segments	None
C	No existing data or spatial and attribute data do not meet recommended standards	Create new centerline segments	Develop required attribute information from resources and data gathered in the field

	Accuracy Levels	
Classification	1 Meter or less	Between 1-3 Meters
A	14	23
B	13	4
C	28	28

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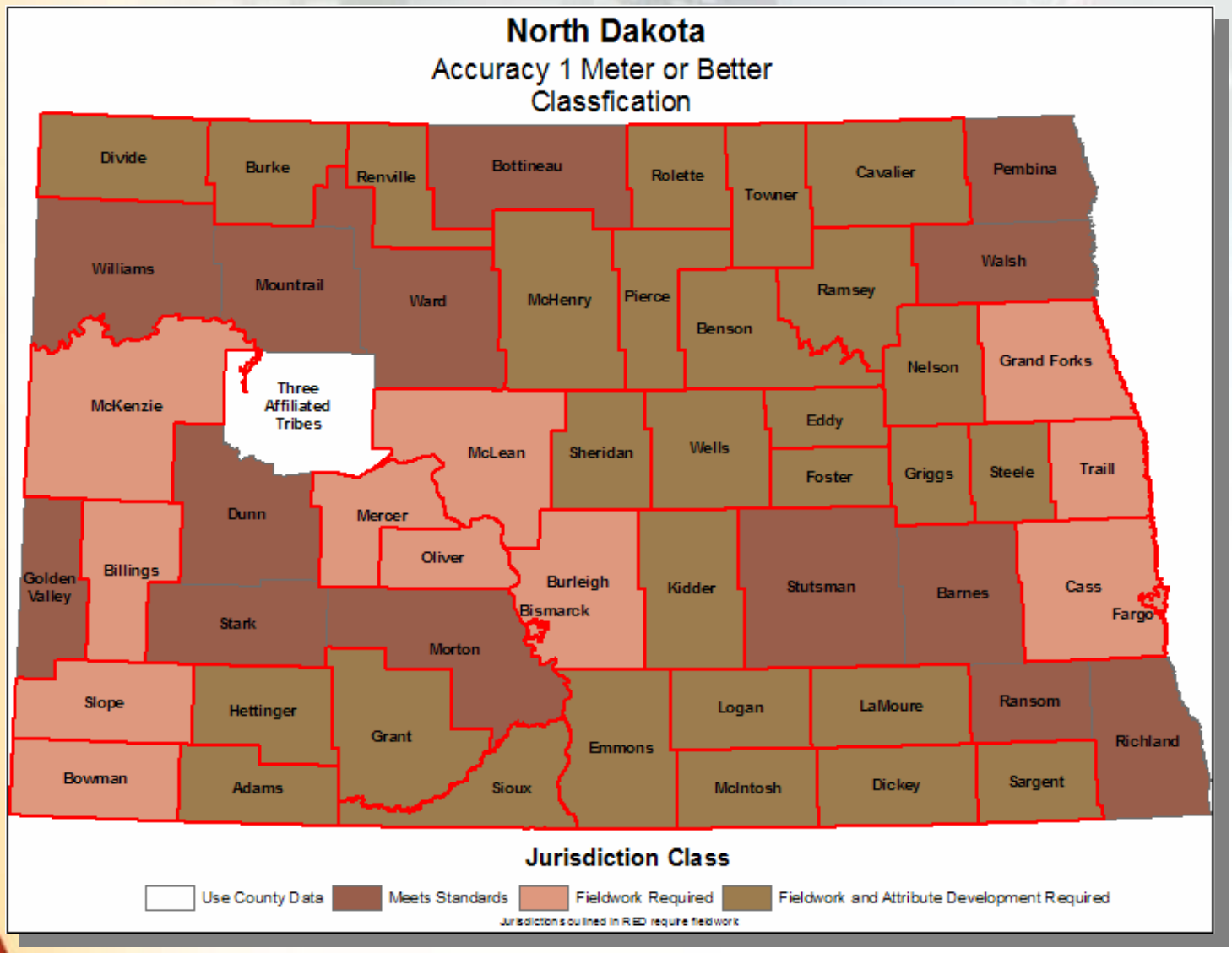

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1 Meter or Better

Classification	Jurisdictions		
A (14)	Barnes Bottineau Dunn Golden Valley Morton Mountrail Pembina	Ransom Richland Stark Stutsman Walsh Ward Williams	
B (13)	Billings Bismarck Bowman Burleigh Cass Fargo Grand Forks	McKenzie McLean Mercer Oliver Slope Traill	
C (28)	Adams Benson Burke Cavalier Dickey Divide Eddy Emmons Foster	Grant Griggs Hettinger Kidder LaMoure Logan McHenry McIntosh Nelson	Pierce Ramsey Renville Rolette Sargent Sheridan Sioux Steele Towner Wells

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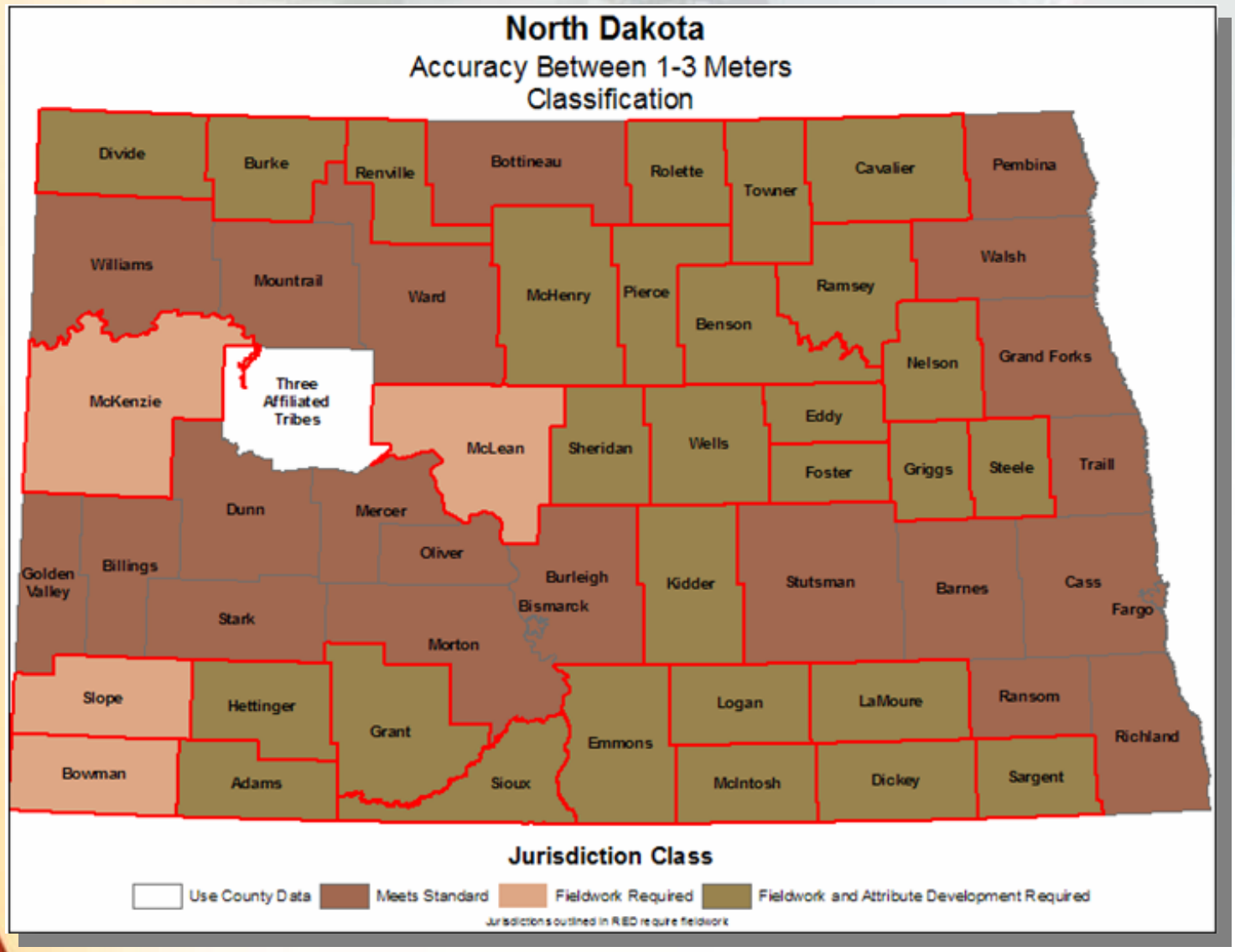

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Between 1-3 Meters

Classification	Jurisdictions		
A (23)	Barnes Billings Bismarck Bottineau Burleigh Cass Dunn Fargo	Golden Valley Grand Forks Mercer Morton Mountrail Oliver Pembina	Ransom Richland Stark Stutsman Traill Walsh Ward Williams
B (4)	Bowman McKenzie McLean Slope		
C (28)	Adams Benson Burke Cavalier Dickey Divide Eddy Emmons Foster	Grant Griggs Hettinger Kidder LaMoure Logan McHenry McIntosh Nelson	Pierce Ramsey Renville Rolette Sargent Sheridan Sioux Steele Towner Wells

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Development Options

Phased Development

- Phase 1 – Initial Development
- Phase 2 – Enhancement

Standard Development

- Utilize existing data that meets standards
- Use GPS and other resources to develop remaining data

Phased Development Plan

Advantages

- Faster development time
- Initially cost effective
- Budget flexibility
- Availability of additional resources

Disadvantages

- Mixed spatial accuracy
- Possible upgrade costs
- Spatial analysis issues

Standard Development Plan

Advantages

- Consistent accuracy across dataset
- Minimum accuracy of 1 Meter or less obtained during data development process
- Standard data set available faster

Disadvantages

- Cost
- Possibly longer development time*

*Project-wide estimated development time dependant on selected vendor resources

Estimated Development Time

Development type		Time estimates per county
Phase 1 Use Census data	Build attribute information only and edge-matching	Average 11 weeks or 2.75 months
Non-Phased Use existing data and GPS to development of spatial and attribute data	Build spatial and attribute information for missing data and edge-matching	Average 17 weeks or 4 months

Project-wide estimated development time dependant on selected vendor resources

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Estimated Costs

Description	Estimated Development Costs	Estimated Completion Time per County
Phased Development		
Phase 1 – Mixed spatial accuracy	**$919,000**	11 Wks
Phase 2 – Updated spatial accuracy	Unknown	
Non-Phased 1 Meter or less spatial accuracy	**$1,850,967**	17 Wks

Suggested Funding Mechanism

- Nebraska
  - Wireless surcharge
  - County responsibility
  - Preferred vendors
- Arizona
  - PSAP Readiness Grant
  - Wireless deployment need accurate GIS data
  - Preferred vendors
- Mid America Regional Council
  - 9-1-1 Surcharge
  - Wireless deployment
  - Single vendor
  - 5 year maintenance program

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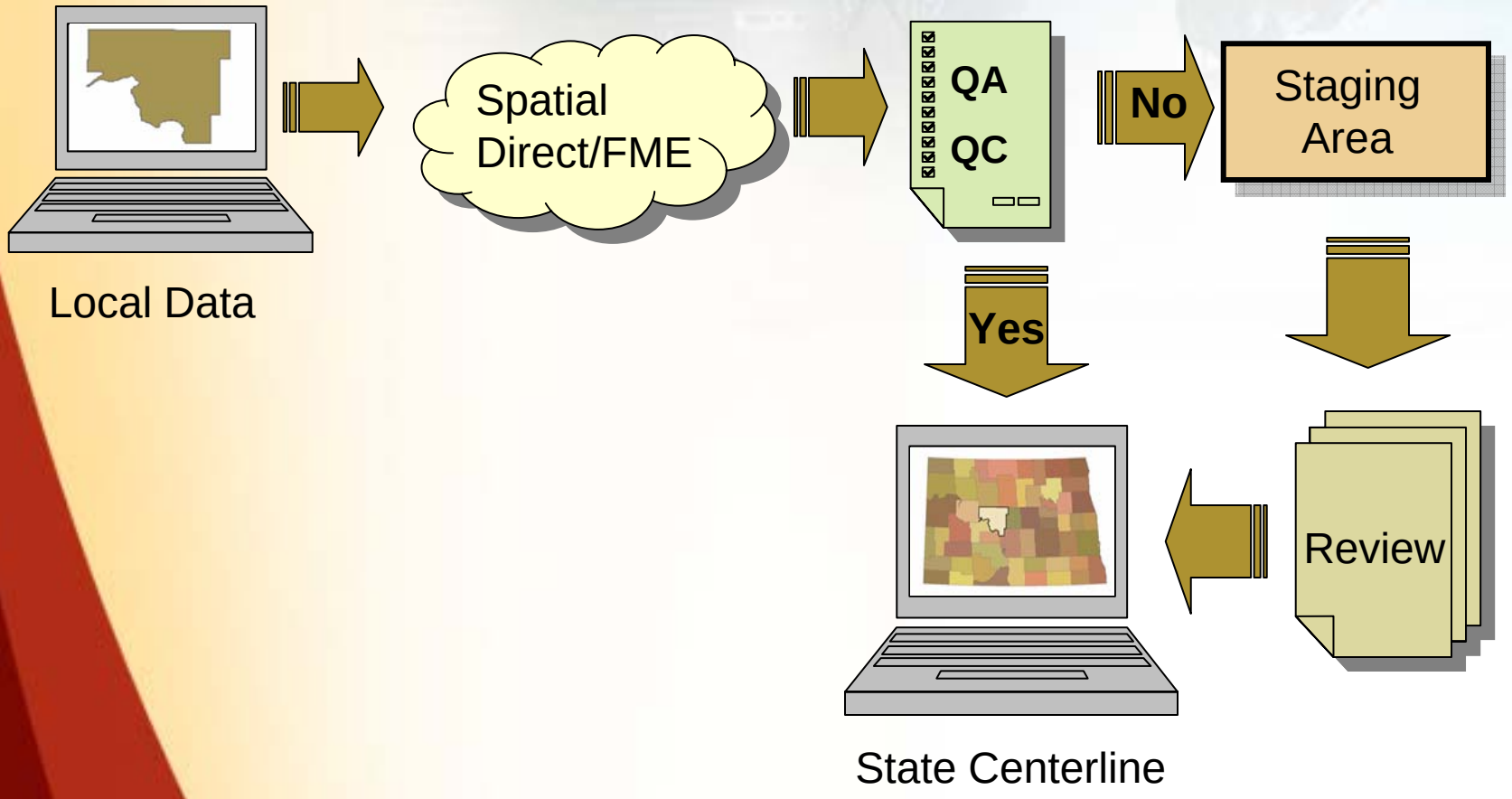
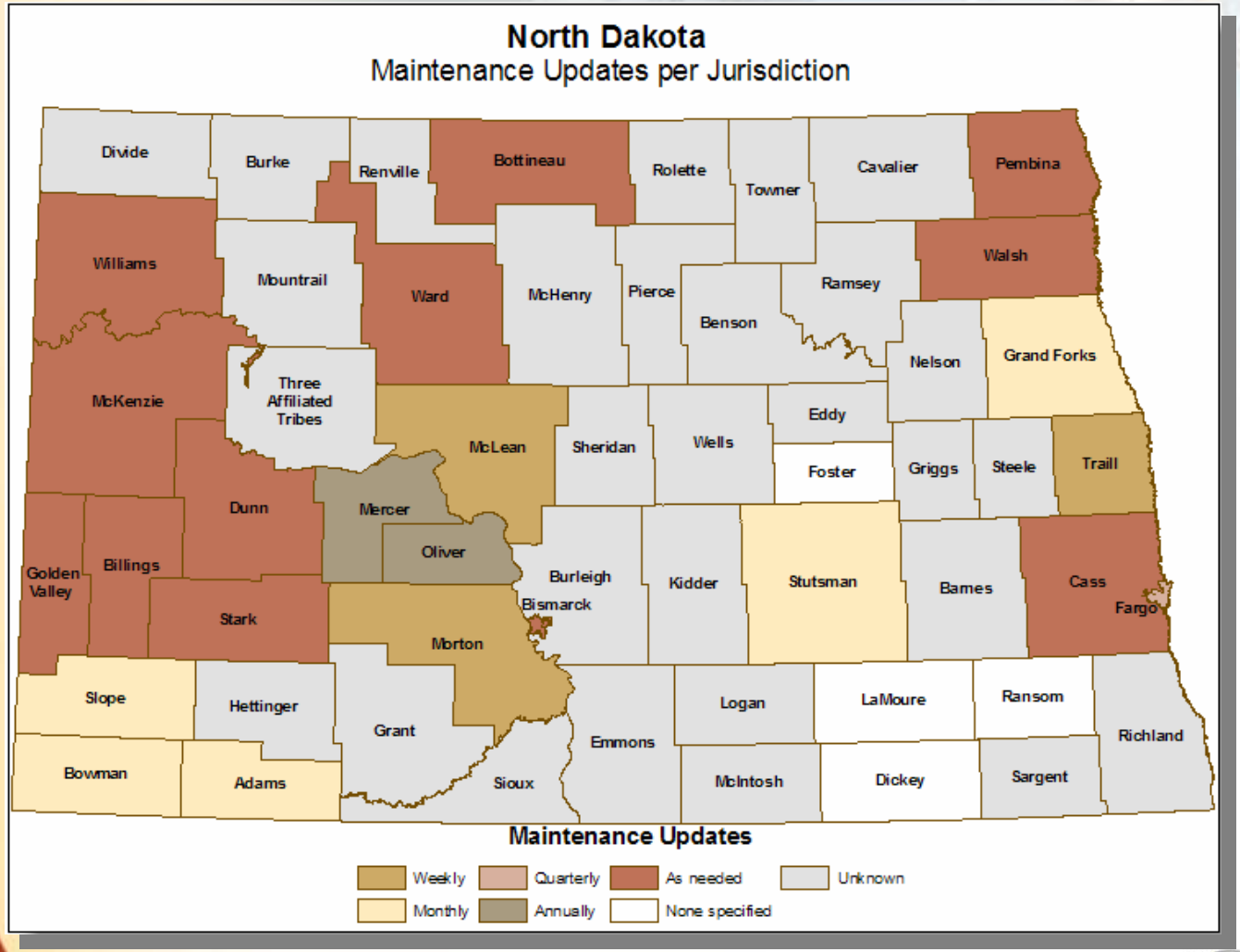
Maintenance Plan

- Local entities
- Data transfer
  - Software recommendations
- Data incorporation
- Quality control

Maintenance Workflow



Reported Maintenance Updates



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Recommended Update Cycle

RECOMMENDED STATE UPDATE SCEDULE	
QUARTERLY	
Jurisdiction	**LOCAL UPDATE SCHEDULE**
McLean	Weekly
Morton	Weekly
Traill	Weekly
Adams	Monthly
Bowman	Monthly
Grand Forks	Monthly
Slope	Monthly
Stutsman	Monthly
Fargo	Quarterly
ANNUALLY	
COUNTY	**LOCAL UPDATE SCHEDULE**
Mercer*	Annual
Oliver*	Annual
Billings	As needed
Bismarck	As needed
Bottineau	As needed
Cass	As needed
Dunn	As needed
Golden Valley*	As needed
McKenzie	As needed
Pembina	As needed
Stark	As needed
Walsh	As needed
Ward*	As needed
Williams*	As needed

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Maintenance Process Options

- Replace local data with each update cycle
  - Repeat edge-matching
  - Data standardization
- Incorporation of changes only
  - Local level
  - State level

Maintenance Program

Responsibility of state maintenance could be handled through:

1. North Dakota Department of Transportation
2. Third party consulting firm
3. Regional consortium

Qualifications for Maintenance Responsibility

1. Dedicated resources and staff
2. Experience in multi-jurisdictional data development and maintenance programs
3. Work with local jurisdictions
4. Extended knowledge of application requirements currently used at the local level, such as Computer Aided Dispatch (CAD)
5. Must have access to Spatial Direct/FME software
6. Work on reducing the level of human intervention in the maintenance process
    - Attribute and spatial changes will need to be adjusted with updated data

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Software Recommendation

- Spatial Direct enterprise license
- Additional FME licenses through Safe Software
- ArcGIS 9.x – ArcInfo
- ArcGIS Server Enterprise
- Database licensing (SQL, Oracle, etc)

Costs will depend on state contract pricing and existing licenses

Personnel Recommendations

1-2 Full time personnel dedicated to the maintenance program

Responsibilities would include:

- Transformation and data review
- Quality Control and Assurance
- Provide local support for implementation of data standards
- Maintenance scheduling
- Collaboration with other departments for utilization of statewide dataset
- Initiate use of data at local level
- North Dakota Road Centerline Data Standards review
- Possible adjustments in North Dakota Road Centerline Data Standards to accommodate future applications

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Next Steps

- Approval of North Dakota Road Centerline Data Standards
  - Organized meetings
  - Level of local involvement
  - Facilitator
    - Experience in multi-jurisdictional data
    - Public safety needs
    - Understanding of various public safety software such as CAD and dispatch mapping applications
  - Discussion of field requirements
  - Unique IDs
- Formalized data sharing agreement

Questions?

Thank you!

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